

The NASA SCI Files™
The Case of the
Biological Biosphere

Segment 4

Jacob is getting close to the departure date of his long-awaited vacation, but he is not doing too well. The tree house detectives try to convince him he must get more rest and eat healthy. They contact Beth Shepherd, lead astronaut strength, conditioning, and rehabilitation specialist at NASA Johnson Space Center in Houston, Texas. Mrs. Shepherd helps the tree house detectives understand why exercise is important in staying healthy. Now the tree house detectives decide that a fitness program is the next step in keeping Jacob healthy. While at NASA Johnson Space Center, they also speak with Dr. Ellen Baker, an astronaut who explains the rigors of working and living in space and how astronauts stay healthy. Dr. Baker reiterates the importance of rest, diet, and exercise. Jacob finally agrees that maybe his methods are not working and ends his quarantine. The detectives go to Dr. D to wrap up their investigation, and Jacob prepares to set sail for the Dry Tortugas, hoping that he stays well just one more day.

Objectives

The students will

- understand the importance of diet, exercise, and rest.
- understand that a person's health is dependent upon many variables.

Vocabulary

ISS—International Space Station

yellow fever—an infectious, often fatal, viral disease of warm climates, transmitted by mosquitoes and marked by high fever, hemorrhaging, vomiting of blood, liver damage, and jaundice

Video Component

Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich the existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

Before Viewing

1. Prior to viewing Segment 4 of *The Case of the Biological Biosphere*, discuss the previous segment to review the problem and what the tree house detectives have learned thus far. Download a copy of the Problem Board from the NASA SCI Files™ web site in the tree house section and have students use it to sort the information learned so far.
2. Review the list of questions and issues that the students created prior to viewing Segment 3 and determine which, if any, were answered in the video or in the students' own research.
3. Revise and correct any misconceptions that may have been dispelled during Segment 3. Use tools located on the Web, as was previously mentioned in Segment 3.
4. Focus Questions—Print the questions from the web site ahead of time for students to copy into their science journals. Encourage students to take notes during the program to answer the questions. An icon will appear when the answer is near.

View Segment 4 of the Video

For optimal educational benefit, view *The Case of the Biological Biosphere* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. At the end of Segment 4, lead students in a discussion of the focus questions for Segment 4.
2. Have students discuss and reflect upon the process that the tree house detectives used to help Jacob stay healthy and infection free. The following instructional tools located in the educator's area of the web site may aid in the discussion: Experimental Inquiry Process Flowchart and/or Scientific Method Flowchart.
3. Choose activities from the educator guide and web site to reinforce concepts discussed in the segment. Pinpoint areas in your curriculum that may need to be reinforced and use activities to aid student understanding in those areas.
4. Wrap up the featured online Problem-Based Learning investigation. Evaluate the students' or teams' final product, generated to represent the online PBL investigation. Sample evaluation tools can be found in the educator's area of the web site under the main menu topic "Tools."
5. Have students write in their journals what they have learned about disease, cells, infection, health, body systems, and/or the problem-solving process and share their entry with a partner or the class.



Resources

Books

D'Amico, Joan and Karen Eich Drummond: *The Healthy Body Cookbook: Over 50 Fun Activities and Delicious Recipes for Kids*. John Wiley, 1999, ISBN: 0471188883.

Frost, Helen: *Drinking Water (The Food Guide Pyramid)*. Pebble Books, 2000, ISBN: 0736805346.

Roccio, Nina M.: *Five Kids & A Monkey Solve the Great Cupcake Caper: A Learning Adventure About Nutrition and Exercise*. Creative Attic, 1997, ISBN: 0965395510.

Web Sites

Education World

This site is a great place for teachers to stop and shop for new lessons on the human body.

http://www.education-world.com/a_lesson/lesson065.shtml

A Look Inside the Human Body

Just click on a body system and explore the world of the circulatory system, the digestive system, and many more. Well done and comprehensive.

<http://users.tpg.com.au/users/amcgann/body/>

The Human Body

This web site is packed with information for students on a variety of topics from viruses to DNA.

http://www.hipopl.org/kids/homeworkcontents/homeworkhelp/human_body/human_body.htm

NASA Spacelink

Visit this NASA web site to learn more about the world of space and astrobiology. Just click on "Instructional Materials" for a wealth of educational resources.

<http://spacelink.nasa.gov>

Careers

astronaut
mission specialist
astronaut trainer
personal trainer
travel agent

Activities and Worksheets

In the Guide	Flexing Your Muscles Create a model of the arm to learn how muscles work.	53
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	Biologically Speaking A word search for highlighting key biology terms.	57
	Across the Biosphere Create your own crossword puzzle using the key biology terms.	58
	Answer Key	59
On the Web	Health Superstitions Learn how superstitions have affected our lives	
	In the Beat of a Heart Observe the pulsation of blood in your wrist	



Flexing Your Muscles

Purpose

To create a model of the arm to understand how muscles work

Background:

Your body is able to twist, turn, flip, bend, reach, and much more due to muscles. There are over 600 muscle groups in the human body, all working together to make sure you can move when needed. However, all this activity results from just one muscle action—contraction. When muscles contract, they make themselves shorter, and when muscles are not contracting, they are relaxing. Your muscles work in teams and every set of muscles has at least one opposing set, so your movements can be reversed. It is very important to keep your muscles healthy by proper exercise.

Materials

thin cardboard or tag board
 scissors
 paper clip
 metric ruler
 2 long balloons
 marker
 tape
 string
 science journal

Procedure

1. Measure the length of your arm from your shoulder to your elbow and record in your science journal. See diagram 1.
2. Measure the length of your arm from your elbow to your wrist and record.
3. Using the measurements cut a cardboard square equal to the measurement for the upper arm.
4. Cut two cardboard squares equal to the measurement for the lower arm.
5. Roll each piece of cardboard tightly and secure with tape. See diagram 2.

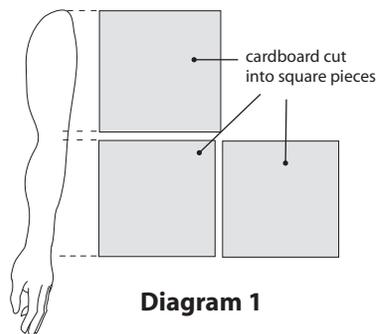


Diagram 1

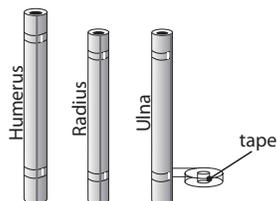


Diagram 2

6. Label the cardboard for the upper arm "Humerus."
7. Label one of the cardboard pieces for the lower arm "Radius" and the other "Ulna."
8. With adult help, make a hole on one end of each of the three rolls.
9. Unbend a paper clip and thread it through the holes, as shown in diagram 3.

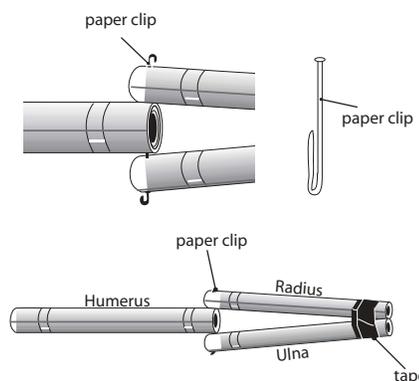
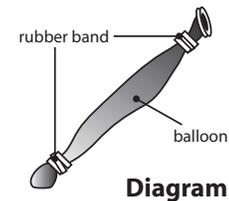
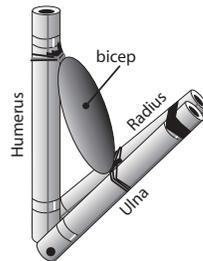
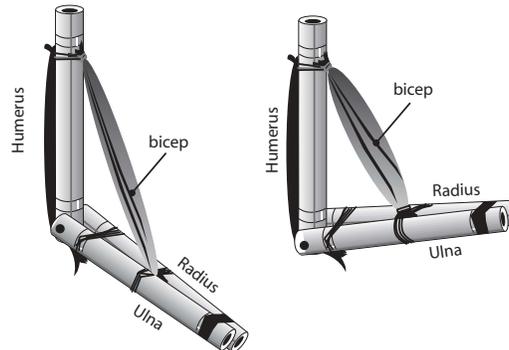


Diagram 3

10. Loop the ends to secure.
11. Slightly inflate both balloons and tie a knot at both ends. See diagram 4.
12. Using string, tie one balloon to the top of the humerus and to the middle of radius and ulna. See diagram 5. This balloon represents the biceps.

**Diagram 4****Diagram 5**

13. Tie the other balloon to the top and bottom of the humerus being sure to include the radius and ulna. See diagram 6.

**Diagram 6**

14. Optional: Trace the outline of your hand onto a piece of cardboard and cut it out. Attach the cutout to the end of the radius and ulna.
15. Bend your arm up and down and observe. Record your observations.

Conclusion

1. Explain what happens when the biceps contract.
2. Why is it important to exercise your muscles?

Extension

1. Perform various movements and find the muscle teams responsible.
2. Research and create a report on the three types of muscles.
3. Research and create a report on foods to eat to promote healthy muscles.
4. Compare and contrast voluntary and involuntary muscles.

Flexibility is the Key

Purpose

To experience gentle stretching exercises to help improve flexibility

A main component of good physical conditioning is having a flexible body. In general, girls are usually more flexible than boys, but by doing some gentle stretching exercises, you can develop good flexibility.

In a large, open area, while wearing comfortable clothing, perform these exercises:

Hippy, Hippy, Leg (Hip and Leg)

Lie on the floor. Lift one leg and grasp the lower leg with both hands. Pull the leg gently toward the nose, keeping the leg straight. Stretch out to the side. Raise the other leg and repeat.

Supple Spine (Spine)

Lie on your stomach. Raise your upper body off the floor, arching the spine. Raise both feet and try to touch your head with your toes.

Low and Behold (Spine and Arms)

Kneel and sit on your heels. Bend down toward the floor until your forehead touches the floor. Stretch your arms in front of you and inhale. Exhale as you stretch your arms out a little farther. Repeat three or four times.

Reach and Reaching (Arm and Shoulders)

Sit on the floor and bend your right arm over the right shoulder. Bend your left arm under your left shoulder. Try to make your hands reach and hold each other. Repeat in the opposite direction.

Kneeing It (Knee)

Stand with both feet flat on the ground. Bend both knees as far as you can without lifting the heel from the floor.

Anklelets (Ankle)

Lie on the floor. Lift one leg and bend the knee so the lower leg is parallel to the floor. Point the toes forward trying to make a straight line. Pull the toes back and stretch the toe toward the shin. Switch legs and repeat. Repeat several times with both legs.

Extension

Create an exercise log and record the exercises you perform each day. Be sure to record the day, date, type of exercise, and the time spent performing each exercise. Evaluate your program with class members and teacher.



Getting to the Heart of the Matter

Purpose

To find your body's resting heart rate
To understand the necessity of exercising the heart muscle

Teacher Prep

Demonstrate how to take someone's pulse using the radial artery located inside the wrist. Have students practice finding each other's pulse and counting the beats.

Materials

stopwatch or watch
with second hand
large area
science journal

Procedure

1. Sit quietly for 5-10 minutes.
2. Estimate your pulse rate for one minute and record in chart below.
3. Have your partner take your pulse rate for one minute and record.
4. Switch roles and find your partner's pulse rate for one minute and record.
5. Stand and touch your toes with your fingertips and stand upright again. Repeat this movement 15-20 times as quickly as possible.
6. Have your partner find your pulse rate for one minute and record.
7. Switch roles and repeat steps 5-6.
8. Do 20-25 jumping jacks as quickly as possible.
9. Have your partner find your pulse rate for one minute and record.
10. Switch roles and repeat steps 8-9.

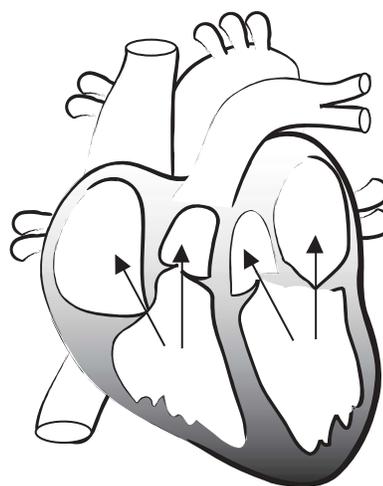
	My Pulse	My Partner's Pulse
Resting		
Toe Touching		
Jumping Jacks		

Conclusion

1. Explain what happened to your heart rate after performing the toe-touching exercise.
2. How did your heart rate change after the jumping jacks? Why?
3. Describe what happened to your body after each exercise.
4. Predict what could happen to your pulse rate if you were to run 2 km. Explain your answer.
5. Is there a limit to how fast your heart can beat?

Extension

1. Research how to find your "target heart rate" during exercise and conduct exercises to maintain the target heart rate.
2. Research and give a report on why your resting heart rate lowers as you become more physically fit.



Biologically Speaking Word Search

Word Bank

cell	muscle	exercise	respiratory	vaccine
bacteria	quarantine	epidemiology	digestive	immunologist
virus	health	disease	toxin	mucus
antibiotic	epidemic	homeostasis	organ	vomit

B N C E L L T D S E A V E S P P A R A T U V
A N M O S P S M G X S A B E H A G U Y I N O
C A Q U M O R P S E V C A C X N R O L E D M
T B F U S P E R U R K M E I C A I P E V V I
E N S A A C O M B C H T I H B G L C H I A T
R H E D L R L U A I R A U X S R L I S T C E
I K A I W O A E N S I N E T I O I I I S C E
A J I L I E S N S E C J I L P L L E U E I N
E L S T Y I D J T I B L S H E A L T H G N T
Z V I R U S I R E I D A I E S I R V A I E I
R E T N E C I P E I N E E T H S C A R D E A
Q Z Q U I C K I A T S E M T F R T E P U N L
R N L D S H I N D I V T L T I S I I T I T T
Y G E A R S Z A S R S U O D R O N C Y A I O
K I V N R T S A Q I A I D N R N E N H J K X
J S E Y K O T C G F Y I Y I I I W N B O N I
H F R T J S Y O R E O P E L L C F I I D A N
P E N E O G L A E R T C K C I B A T S T R F
U E R E I O S I D K Z U U A E O I S H I C T
Y K M E N I T G A D T B I S B O L L I I I S
T O E U S B E K I S R I H Y O M J A C O N I
H G M M A I M O R E S P I R A T O R Y A L P
O M W E P I D E M I C E I K K I N Y I R P V
I F A A N T I B I O T I C L F U M U C U S V



Answer Key

Flexing Your Muscles

1. When the biceps contract, they get larger. When someone “shows us his muscle” he is contracting his biceps, which creates a bulge. The biceps contract to pull up the lower arm bone.
2. Answers will vary but should include that exercise is important to keep muscles in good physical condition so that they are able to do all the motions required of the body throughout the day. Poor muscle condition can lead to poor health.

Getting to the Heart of the Matter

1. Your heart rate increased.
2. Your heart rate had a greater increase because jumping jacks required more physical activity than the toe-touching exercise. With increased physical activity, the heart has to pump harder to oxygenate the blood.
3. Answers will vary but should include that during each exercise, the body responded according to its level of fitness. The less physically fit people are, the more difficulty they will have in breathing and the more easily they will tire. After the exercises were complete, the pulse rate returned to normal.
4. Answers will vary but should include that the pulse rate will increase.
5. There is a limit to the number of beats per minute the heart can beat safely. If a heart beats too fast it can cause serious health problems.

Biologically Speaking (Word Search)

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B N C E L L T D S E A V E S P P A R A T U V
A N M O S P S M G X S A B E H A G U Y I N O
C A Q U M O R P S E V C A C X N R O L E D M
T B F U S P E R U R K M E I C A I P E V V I
E N S A A C O M B C H T I H B G L C H I A T
R H E D L R L U A I R A U X S R L I S T C E
I K A I W O A E N S I N E T I O I I I S C E
A J I L I E S N S E C J I L P L L E U E I N
E L S T Y I D J T I B L S H E A L T H G N T
Z V I R U S I R E I D A I E S I R V A I E I
R E T N E C I P E I N E E T H S C A R D E A
Q Z Q U I C K I A T S E M T F R T E P U N L
R N L D S H I N D I V T L T I S I I T I T T
Y G E A R S Z A S R S U O D R O N C Y A I O
K I V N R T S A Q I A I D N R N E N H J K X
J S E Y K O T C G F Y I Y I I W N B O N I
H F R T J S Y O R E O P E L L C F I I D A N
P E N E O G L A E R T C K C I B A T S T R F
U E R E I O S I D K Z U U A E O I S H I C T
Y K M E N I T G A D T B I S B O L L I I S
T O E U S B E K I S R I H Y O M J A C O N I
H G M M A I M O R E S P I R A T O R Y A L P
O M W E P I D E M I C E I K K I N Y I R P V
I F A A N T I B I O T I C L F U M U C U S V
    
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On the Web

Health Superstitions (And Other Quacky Ideas)

1. Answers will vary but might include that false advertisement, phony doctors, ignorance (lack of knowledge), and fear can all start a superstition.
2. Answer will vary but might include that people often believe in superstitions because they learned them from their parents or because they have a health crisis that has made them feel desperate or deprived them of hope.

In the Beat of a Heart

1. As the heart contracts, blood is forced through the blood vessels at a rhythmic rate. All blood vessels have this throbbing motion, but the vessels in the wrist are close to the surface of skin and can be more easily felt.
2. Heart rates vary among people for many reasons. A person’s heart, age, health, and/or the amount of physical activity occurring may determine this variance. For an average adult, a pulse rate between 60 and 80 is normal and for children it is about 80 to 140 beats per minute.

